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DODPOPHM/USA/DOD/NADTR91109

PERFORMANCE ORIENTED PACKAGING TESTING

OF

WOOD BOX

FOR

M83769/4-1 BATTERY

BY:

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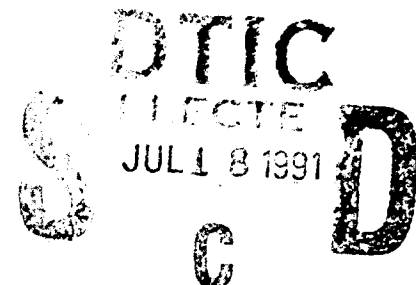
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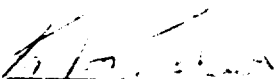
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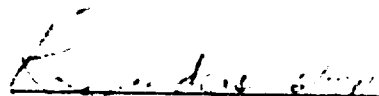


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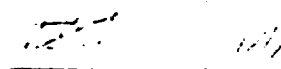
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<p>The current packaging configuration for the M873769/4-1 Battery was tested for conformance to Performance Oriented Packaging regulations. The cleated plywood box was tested with a gross weight of 214 pounds and met the requirements and retained its contents.</p>				
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## INTRODUCTION

The current packaging configuration for the M83769/4-1 Battery was tested to ascertain whether it would meet the requirements of Performance Oriented Packaging (POP) as specified by the United Nations Recommendations on the Transport of Dangerous Goods Document, ST/SG/AC.10/1, Revision 6, Chapters 4 and 9. A base level vibration test was also conducted in accordance with the rulings specified in the Federal Register/Vol. 55, No. 246/Friday, December 21, 1990/Final Rule. The objectives were to evaluate the adequacy of the packaging in protecting the hazardous materials.

The packaging tested is a combination packaging consisting of an inner pack inside a lined wood box. The inner pack for the battery is a fiberboard box with polystyrene dunnage, which is sealed in a MIL-B-117 barrier bag. The inner pack is placed in the approximate center of a cleated plywood box with a MIL-B-131 liner and the remaining space is filled with absorbent material, P-A-1056. The box lid is secured with nails and two .75-inch wide steel bands. The batteries used during the tests contained water in place of the acid.

## TESTS PERFORMED

### 1. Drop Test

This test was performed in accordance with ST/SG/AC.10/1, Chapter 9, Paragraph 9.7.3. Four outer containers were used throughout the test series. The drop height was 0.8 meters and the drop sequence was as follows:

- a. Flat on Bottom
- b. Flat on Top
- c. Flat on Long Side
- d. Flat on Short Side
- e. One Corner

The test was performed at ambient temperature ( $70^{\circ} \pm 20^{\circ}\text{F}$ ). The contents of the container should be retained within its packaging and exhibit no damage liable to affect safety during transport.

### 2. Stacking Test

This test was performed in accordance with ST/SG/AC.10/1, Chapter 9, Paragraph 9.7.6. Three different outer containers were used, each with a stack weight of 800 pounds. The test was performed for 24 hours. After the allowed time, the weight was removed and the container examined. Any leakage, deterioration, or distortion which could adversely affect transport or reduce its strength or cause instability in stacks of packages is cause for rejection.

### 3. Base Level Vibration Test

This test was performed in accordance with Federal Register/Vol 55, No. 246/Friday, December 21, 1990/Final Rule. Three outer containers were loaded with a water-filled battery and closed as for shipment. Each container was placed on a vibrating platform that had a vertical double-amplitude (peak-to-peak displacement) of one inch. The packages were constrained horizontally to prevent them from falling off the platform, but were free to move vertically, bounce and rotate. The test was performed for one hour at a frequency that caused each point of the container bottom to be raised from the platform 1/16-inch. A 1/16-inch thick metal strip was passed between the bottom of the container and the platform.

#### TEST RESULTS

##### 1. Drop Test

Satisfactory.

##### 2. Stacking Test

Satisfactory.

##### 3. Base Level Vibration Test

Satisfactory.

#### DISCUSSION

##### 1. Drop Test

After each drop the container was inspected for any damage which would be cause for rejection. Each box received minor damage during the tests, but retained the inner pack and the absorbent material. Figure 1 shows the container after the corner drop, which caused the most damage. After the corner drop, the battery was removed from the inner pack and inspected. The water had leaked from the battery case, but was retained within the inner pack.

##### 2. Stacking Test

Three outer containers were individually tested. Each container was visibly inspected at the completion of the 24-hour test period. There was no leakage, distortion, or deterioration to any of the containers as a result of this test.

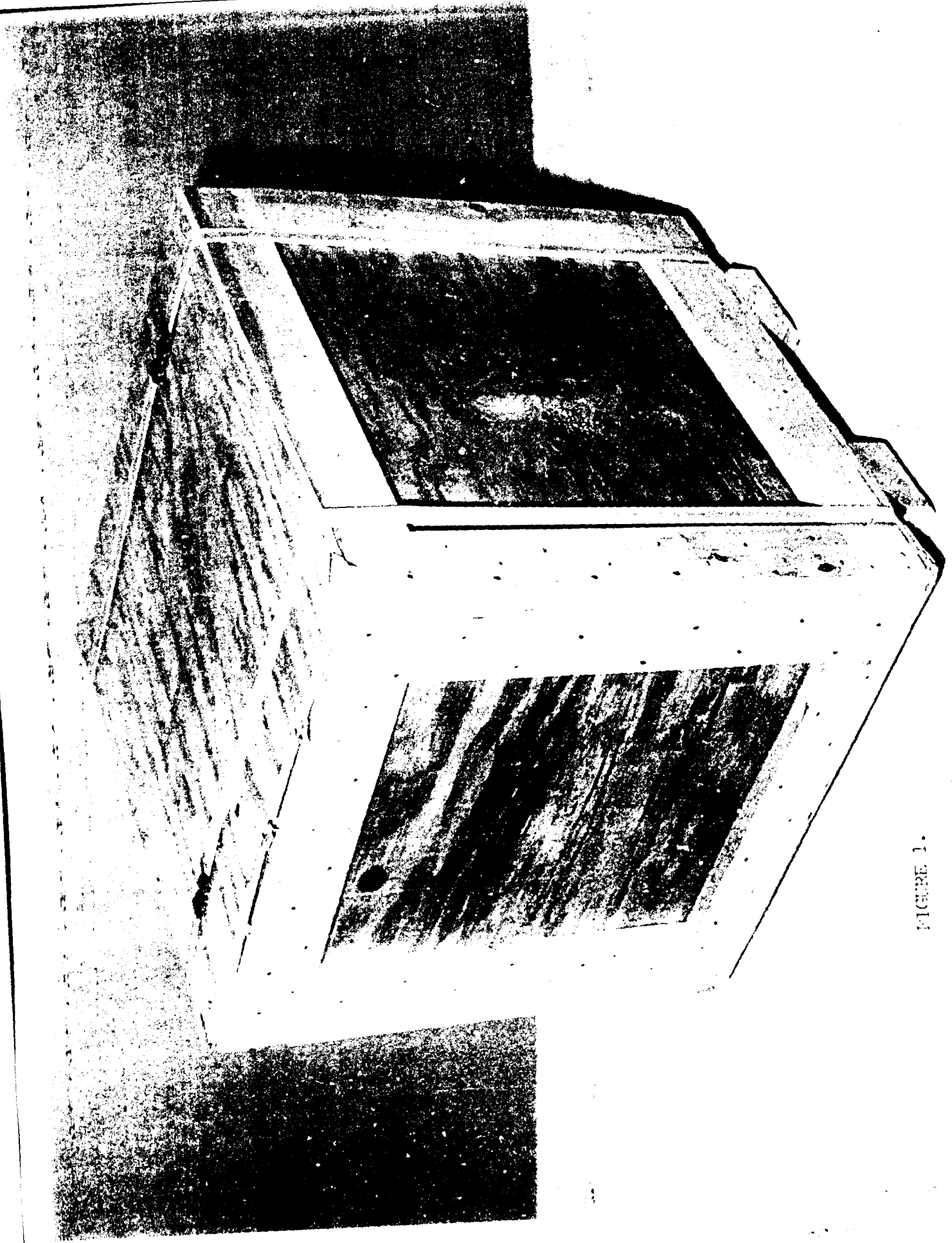


FIGURE 1.  
Box 162 after corner drop.

### 3. Base Level Vibration Test

Immediately following the vibration test, each container was removed from the platform, turned on its side and observed for any evidence of leakage. All containers remained intact and there was no evidence of leakage of contents.

#### PASS/FAIL (UN CRITERIA)

The criteria for passing the drop test is outlined in Paragraph 9.7.3.5 of ST/SG/AC.10/1 and states the following: "Each packaging containing liquid should be leakproof when equilibrium has been reached between the internal and external pressures, except for inner packagings of combination packagings when it is not necessary that the pressures be equalized".

The criteria for passing the stacking test is outlined in Paragraph 9.7.6.3 of ST/SG/AC.10/1 and states the following: "No test sample should show any deterioration which could adversely affect transport safety or any distortion liable to reduce its strength or cause instability in stacks of packages".

#### PASS/FAIL (FEDERAL REGISTER CRITERIA)

The criteria for passing the Base Level Vibration Test is outlined in the Federal Register/Vol. 55, No. 246/Friday, December 21, 1990/Final Rule and states the following: "Immediately following the period of vibration, each package shall be removed from the platform, turned on its side and observed for any evidence of leakage. Rupture or leakage from any of the packages constitutes failure of the test".

#### DISCUSSION

Even though the outer container did not spill any hazardous material, there was some leakage within the inner pack. The water that had been placed in the battery for the tests had leaked out of the battery, but was retained by the inner pack's sealed barrier bag.

During the drop tests, the edges of the wood boxes separated enough for significant amounts of the absorbent material to leak out of the box had the liner not been in place. The liner is necessary for the box to retain all of the contents.

The wood boxes tested rely heavily upon the liners and inner packs to retain the hazardous materials. Approval of the combination packaging tested herein should not be construed as approval of the wood box for use without an appropriate inner pack and liner.

## REFERENCE MATERIAL

United Nations "Recommendations on the Transport of Dangerous Goods", ST/SG/AC.10/1, Revision 6

49 CFR Part 107, et al. Performance Oriented Packaging Standards, Federal Register/Vol. 55, No. 246/Friday, December 21, 1990/Final Rule

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# DATA SHEET

CONTAINER: Cleated Plywood Box For M83769/4-1 Battery

Type: 4D

UN Code: 8

Specification Number:  
PPP-B-601

Material:  
Plywood

Capacity:  
97.38 kg  
(214 pounds)

Dimensions:  
.53 m (L) x .53 m (W) x .58 m (H)  
(21" L x 21" W x 23" H)

Closure (Method/type):  
Nails  
Steel Strapping

Tare Weight:  
14.53 kg  
(32 pounds)

Additional Description: Battery is packed in fiberboard box with polystyrene dunnage, sealed in MIL-B-117 barrier bag and packed in absorbent material, P-A-1056. Wood box is lined with MIL-B-131 barrier material.

## PRODUCTS:

M83769/4-1 Battery  
NSN 6140-00-135-0229

Proper Shipping Name:  
Batteries, Wet, Filled with Acid, Electric, Storage

United Nations Number: 2794

United Nations Packing Group: III

Physical State: Liquid

Amount Per Container: One (1)

Net Weight: 24.97 kg (55 pounds)

## TEST PRODUCT:

Name: Inert M83769/4-1 Battery  
Physical State: Liquid

Size : .27 m L x .26 m W x .23 m H  
(10.7" L x 10.1" W x 8.9" H)

Quantity : One (1)

Dunnage: Polystyrene foam, absorbent material  
Gross Weight: 97.38 kg (214 pounds)